CLAIMS

[1] A method of producing hydrogen by supplying steam to a cathode side and supplying a reducing gas to an anode side of a high-temperature steam electrolysis apparatus in which an electrolysis vessel is partitioned into the anode side and the cathode side using a solid oxide electrolyte membrane as a diaphragm, and carrying out steam electrolysis at high temperature,

the method being characterized in that the reducing gas and the steam supplied into the electrolysis vessel are made to have a temperature in a range of 200 to 500°C.

[2] The method of producing hydrogen according to claim 1, characterized in that the reducing gas and the steam supplied are heated to a temperature in a range of 200 to 500°C by carrying out heat exchange with high-temperature offgas and high-temperature hydrogen.

[3] The method of producing hydrogen according to claim 1, characterized in that the reducing gas and the steam supplied are heated to a temperature in a range of 200 to 500°C by carrying out heat exchange with waste heat from another process.

[4] The method of producing hydrogen according to claim 1, characterized in that the supplied reducing gas is heated to a temperature in a range of 200 to 500°C by adding high-temperature gas thereto.

[5] The method of producing hydrogen according to claim

1 or 4, characterized in that the supplied reducing gas or mixed gas of the reducing gas and high-temperature gas, and the steam are heated to a temperature in a range of 200 to 500°C by carrying out heat exchange with high-temperature offgas and high-temperature hydrogen.

[6] The method of producing hydrogen according to claim 1 or 4, characterized in that the supplied reducing gas or mixed gas of the reducing gas and high-temperature gas is heated to a temperature in a range of 200 to 500°C by carrying out heat exchange with waste heat from another process.

[7] The method of producing hydrogen according to any of claims 1 through 6, characterized by operating with an electrolysis voltage in a range of 20 to 40% of a required energy.

[8] The method of producing hydrogen according to any of claims 1 through 7, characterized in that a concentration of hydrochloric acid and/or sulfur compounds in the supplied reducing gas is made to be not more than 10 ppm.

[9] The method of producing hydrogen according to any of claims 1 through 8, characterized in that the supplied reducing gas is a reducing gas produced through pyrolysis of organic matter, and is cleaned/de-dusted using a scrubber or the like.

[10] The method of producing hydrogen according to any of claims 1 through 8, characterized in that the supplied reducing gas is by-product gas produced by a coke oven or a

blast furnace of an ironworks.

[11] The method of producing hydrogen according to any of claims 1 through 8, characterized in that the supplied reducing gas is by-product gas from a petroleum plant.

[12] The method of producing hydrogen according to claim 9, characterized in that the pyrolysis raw material organic matter is biomass such as waste wood or garbage, and petroleum residue.

[13] A hydrogen producing apparatus comprising an electrolysis vessel partitioned into an anode side and a cathode side by a solid oxide electrolyte diaphragm, a pipeline supplying a reducing gas to the anode side of the electrolysis vessel, and a pipeline supplying steam to the cathode side of the electrolysis vessel,

characterized by further comprising means for heating

the reducing gas and the steam supplied into the electrolysis vessel to a temperature in a range of 200 to 500°C.

[14] The hydrogen producing apparatus according to claim 13, characterized in that a flow control valve is provided in each of the pipeline supplying the reducing gas to the anode side of the electrolysis vessel and the pipeline supplying the steam to the cathode side of the electrolysis vessel, so as to optimally control operating conditions.

[15] The hydrogen producing apparatus according to claim 14, characterized in that a temperature gauge is provided in a gas outlet line on the anode side and the cathode side

of the electrolysis vessel, and the flow control valves are controlled so as to obtain a constant temperature.